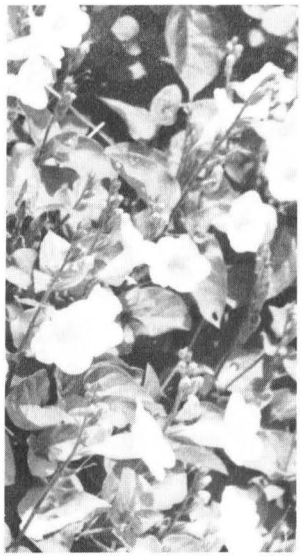
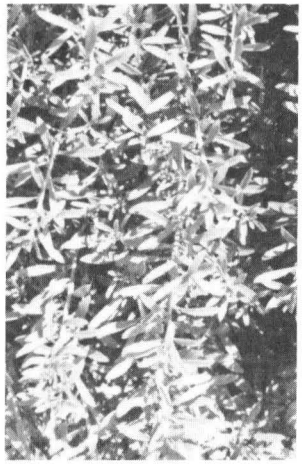
March 1976





Ground cover survival and growth

Criley, Kunimitsu, Parvin, and Degen

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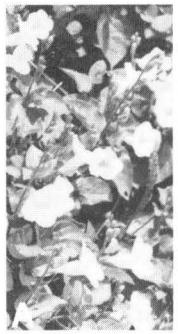

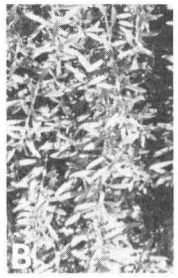

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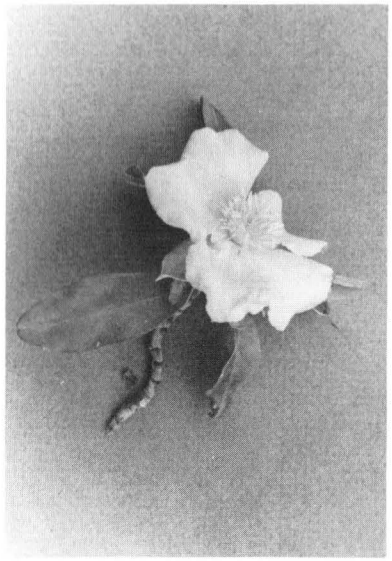
Ground covers on the front cover: (A) coromandel, *Asystasia gangetica*; (B) spreading myoporum, *Myoporum parvifolium*; (C) trailing gazania, *Gazania uniflora leucoleana*; and (D) varigated St. Augustinegrass, *Stenotaphrum secundatum variegatum*.



Hibbertia scandens. **Survival rated "good" at Kula, Island of Maui.**

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Objectives and General Observations

Seventy-five ground covers were planted in various locations on Oahu and Maui to evaluate their growth and survival under low maintenance after establishment.

The plantings demonstrated that the best plants for rapid coverage under good establishment conditions to be followed by minimal maintenance are *Arctotheca calendula, Gazania uniflora leucoleana, Myoporum parvifolium,* and *Osteospermum fruticosum.* Others that performed well include *Baccharis pilularis, Delosperma* 'Alba,' *Ficus tikoua, Grevillea noelli, Grevillea obtusifolia, Grevillea* 'Rock Garden,' *Lonicera japonica* 'Halliana,' *Potentilla verna,* and *Ruellia ciliosa.* Certain ground covers that are rampant and weedlike but nonetheless suitable for adverse conditions include *Asystasia gangetica, Atriplex semibaccata* (a beach native sometimes called saltbrush), *Jacquemontia sandwicensis,* and *Polygonum capitatum.* Certain of the ground covers already established in landscape use could be used to provide greater variety, including *Asparagus sprengeri,* the prostrate forms of *Carissa grandiflora, Dissotis plumosa, Gardenia radicans, Hemigraphis colorata, Trachelospermum asiaticum, Trachelospermum jasminoides,* and *Wikstroemia uva-ursi.*

The various succulent plant materials, such as sedums and iceplant, do survive at low elevations, but they appear to grow and bloom more vigorously at higher elevations where the nights are cool. Many of the plant materials that were not satisfactory at low elevations were quite desirable at higher elevations; these included, in addition to sedums and iceplants, *Cerastium tomentosum, Convolvulus mauritanicus, Cotoneaster liaking, Fragaria chiloensis, Hypericum coris, Iberis sempervirens, Jasminum polyanthum, Lotus bertholetti,* and *Lysimachia nummularia.*

Experimental Conditions

Waimanalo Research Station

Two separate plantings were made at the Waimanalo Experimental Farm on windward Oahu, approximately 50 to 70 feet above sea level where the average rainfall is about 40 inches (with a range of 32 to 85 inches), most rain falling from December to March. Supplemental overhead irrigation was used to provide approximately 1 inch water per week. Prior to planting, 8 pounds of 16-16-16 fertilizer were added to each 1000 square feet of dark magnesium clay soil. The plantings were exposed to strong northeast trades, with the following average maximum/minimum temperatures in Fahrenheit: summer—83/73; fall—81/71; winter—78/68; and spring—80/70.

Rooted cuttings were planted in March 1969 and in August 1970. The soil was fumigated with methyl bromide to control weeds while the young plants

were becoming established. Weed encroachment resumed in about 3 months. Hot and dry conditions following the August 1970 plantings were responsible for the loss of some poorly rooted plants. Other losses were caused by flooding by the irrigation system. Final readings on the first plantings were recorded in June 1971 and on the second plantings in June 1972.

Sandy Beach Botanic Garden

Other plantings were made at the Sandy Beach Botanic Garden with the cooperation of the Parks and Recreation Department of the City and County of Honolulu. This sea level site with a leeward exposure receives strong winds from an easterly direction carrying ocean spray directly over the plantings. Rainfall in this area was less than 25 inches per year (a 30-year average provided by the National Weather Service, Honolulu). At this location, no irrigation was provided to the plants after establishment. Before planting, 8 pounds of 16-16-16 fertilizer were applied to each 1000 square feet of heavy red clay soil. The average annual maximum temperature is about 77° F and the average annual minimum temperature is about 69° F.

Two plantings of rooted cuttings were made, one in February 1969 and one in October 1970. Weekly irrigation was available for 3 months after the first planting, but none was provided after the second. Some hand weeding was practiced while the plants were being established; bermudagrass was the chief competitor. Final evaluations were recorded in June 1972.

Kahuku High School

A third site was at the Kahuku High School on the windward side of Oahu, at 50 feet elevation with winds, indirect salt spray, and an average rainfall of about 17 inches, mostly during the winter months. The maximum daily temperature, spring through fall, was about 83° F, and the minimum night temperature ranged from 68 to 71° F. During the winter, the daily maximum/minimum averages were 79/65° F.

Two plantings of rooted cuttings were made in August 1971 into a moderately alkaline sandy soil and a moderately alkaline clay soil fumigated with methyl bromide. Nutrients were supplied by fertilizing monthly with 16-16-16 fertilizer at the rate of 1 pound per 100 square feet soil. The experimental plots were weeded once a month by hand and hoe by the Future Farmers of America at Kahuku High School, and in the process some plants were accidentally lost. Final evaluations were made in December 1971.

Kula Experiment Station

The Maui Branch (Kula) Experiment Station at 3200 feet elevation, representing a temperate climate, was the fourth site on which ground covers were grown. The average annual rainfall was 30 inches, falling primarily in the winter months. Supplemental overhead irrigation was used to supply approximately 1 inch water per week when required. Thirty pounds of 16-16-16 fertilizer were incorporated into each 1000 square feet of the dark reddish brown loam soil. The day/night temperature averages in Fahrenheit by season at this location were as follows: summer—74/59; fall—73/58; winter—69/56; and spring—69/57.

Rooted cuttings were planted in January 1969 and in September 1970. Establishment was generally rapid, and weed problems were minimal. Final evaluations were made in June 1972.

Many of the plant materials used in these experiments were described in University of Hawaii Extension Circular 457. Others were catalogued in the offerings of various Hawaii and Mainland nurseries.

Results

The observations reported in the accompanying table are necessarily brief. The survival ratings are the result of considering the short-term survival after cuttings were planted and the long-term survival with reduced maintenance. The growth evaluations were primarily indicative of whether the plant is a fast, vigorous one and adapted to that site or whether it performs poorly over the long run. Nearly all these plant materials will survive if given enough care. For many purposes, however, a minimal amount of maintenance is desired; in such cases, only the more sturdy plant materials should be used.

Stenotaphrum secundatum variegatum. **Very vigorous growth at Waimanalo, Island of Oahu.**

Evaluation of ground covers at four locations for survival and growth[a]

Plant material	Kula		Waimanalo		Sandy Beach		Kahuku	
	Survival	Growth	Survival	Growth	Survival	Growth	Survival	Growth
Ajuga reptans			none	all plants died, conditions too sunny & dry				
Arctotheca calendula	excellent	vigorous, good for erosion control; some dieback, recovery good	excellent	vigorous, crowds out weeds; some dieback recovery good	good	good even with little water & sea coast exposure	excellent	vigorous in sandy soil near beach
Arctotis acaulis			good	in clumps, does not spread; flowers red, yellow, orange, pink[b]			fair	moderate in both sandy & clay soil
Armeria maritima vulgaris	good	mounds on itself; some dieback in exposed areas	poor	poor, too sunny & dry; wind erosion undermined plants				
Asparagus sprengeri			good	surprisingly good for exposed conditions; light green color				
Asystasia gangetica			excellent	white form more vigorous than purple; seeds itself	good	good even with little water & direct exposure to salt spray		
Atriplex semibaccata			excellent	spreads quickly; tiny red flowers when watered	excellent	withstands drought, salt, & strong winds	fair	sparse & weedlike in short term; all right for sandy soil
Baccharis pilularis			excellent	vigorous & mounded at about 18 inches	good	plant remained quite prostrate	fair	good establishment conditions necessary; satisfactory in sandy & clay soil
Baccharis pilularis 'Twin Peaks'	excellent	vigorous; mounds on itself to 3-ft depth	good	somewhat less vigorous than wild form; lower habit	poor	plant requires more attention during establishment; slow & prostrate		
Bougainvillea glabra 'Temple Fire'			good	slow; plant stays low & twiggy				
Campanula poscharskyana	good	not strongly competitive	poor	conditions too hot & dry				
Carissa grandiflora 'Green Carpet'			good	plants doubled in size in 18 mo.; low				
Carissa grandiflora 'Tuttlei'			good	plants doubled in size in 18 mo.; low				
Carpobrotus edule			fair	soil too heavy; root systems poor from over-watering				

—Continued

[a]Survival was rated **poor**, most plants died; **fair**, only a few plants lived; **good**, most plants lived; and **excellent**, all plants lived and some increased the population through seeding or vegetative renewal.

[b]Leaf color and flower color appear in several instances in this chart since some of these ground covers were not described in Circular 457 or elsewhere.

Evaluation of ground covers at four locations for survival and growth—Continued

Plant material	Kula		Waimanalo		Sandy Beach		Kahuku	
	Survival	Growth	Survival	Growth	Survival	Growth	Survival	Growth
Cerastium tomentosum	excellent	vigorous; attractive grey-green foliage; flowers white	poor	conditions too warm	none	all plants died, not tolerant of salt spray		
Ceratostigma plumbaginoides			poor	well-rooted plants necessary; slow; intense blue flowers			poor	vigorous once established; low; attractive foliage, flowers
Convolvulus mauritanicus	good	moderate; low; attractive flowers, 1-inch height, light blue	poor	crowded out by weeds				
Cotoneaster liaking	excellent	vigorous; prostrate habit; blooms & fruits well; used for erosion control	fair	moderate; no flowers				
Cuphea ignea			fair	conditions too dry; did not compete well with weeds				
Delosperma 'Alba'	excellent	mats down to about 8 inches thick; vigorous; dark green plant, white flowers	fair to good	did not perform well where drainage was poor; moderate in heavy soil	good	vigorous even under dry conditions, wind, & salt spray		
Dichondra carolinensis			good	best under slight shade from other plants; too dry in full sun				
Dissotis plumosa	fair	weak	excellent	vigorous; flowers heavily; attacked by Chinese beetle				
Drosanthenum hispidum	excellent	vigorous; dense & low; 1-inch pink flowers	fair	slow & sparse			good	vigorous on heavier soil; low
Erodium chamaedryoides roseum	good	slow; mounds on itself	fair	slow; may be attacked by root-knot nematode	good	slow; deep rooted		
Euonymous radicans variegata	fair	slight	poor	of rooted cuttings almost nil				
Ficus pumila variegata			good	vigorous when sufficiently watered but tends to burn in full sun				
Ficus tikoua			good	vigorous; low; good for erosion control				
Fragaria chiloensis	good	dense; dark-green foliage; subject to leaf spotting; flowers	good	vigorous but subject to crown rot if too wet	good	fair but fails to root in dry soil, especially when wind whipped		

—Continued

Evaluation of ground covers at four locations for survival and growth—Continued

Plant material	Kula		Waimanalo		Sandy Beach		Kahuku	
	Survival	Growth	Survival	Growth	Survival	Growth	Survival	Growth
Gardenia radicans			good	low; dark green; white flower; moderate				
Gazania x 'Copper King'			good	mounding habit; flowers freely				
Gazania rigens			good	spreads slowly; flowers freely; re-seeds itself				
Gazania uniflora leucoleana	excellent	vigorous; low; flowers freely; good bank cover	excellent	vigorous; low; flowers freely; center dies out but regrowth occurs	excellent	low; vigorous; withstands drought, wind, & salt spray	excellent	readily propagated; very vigorous in both sandy & clay soil; heavy flowering year-round
Grevillea noelli	excellent	vigorous; mounds on itself to 2 ft; dark green; inconspicuous white flowers	excellent	moderate & upright; no flowers	fair	slow under dry & windy conditions		
Grevillea obtusifolia	excellent	vigorous; prostrate; good dark-green color; red flowers	good	rapid; prostrate; light green; no flowers			poor	difficult to root
Grevillea x 'Rock Garden'	excellent	very vigorous; mounds on itself to 18 inches; red flowers; dense	good	competes well with poor weeds; low; flowers abundantly	poor	cuttings not well rooted; more attention required for establishment	poor	difficult to root
Hedera helix			none	all plants died				
Heliotropum curassavicum			fair	good rate of growth but not a strong competitor; silvery grey foliage	fair	beach native; prostrate; seeds itself		
Hemigraphis colorata			good	vigorous once established; dark reddish foliage with metallic sheen				
Herniaria glabra	good	moderate; forms dense mat of fine green stems	fair	not a vigorous competitor; slow & very low	poor	requires more water		
Hibbertia scandens	good	moderate; vine-like habit; yellow flowers						
Hypericum coris	excellent	vigorous; makes grey-green mound but roots down	fair	slow unless protected; would do better with more water				
Iberis sempervirens	good	moderate; flowers well	fair	poor; probably too warm & too dry				
Jacquemontia sandiwicensis			good	very prostrate; not dense; blue flowers	good	beach native; tolerant of dry, windy conditions; roots down well	good	vigorous in heavy clay soil

—Continued

Evaluation of ground covers at four locations for survival and growth—Continued

Plant material	Kula		Waimanalo		Sandy Beach		Kahuku	
	Survival	Growth	Survival	Growth	Survival	Growth	Survival	Growth
Jasminum parkeri	fair	slow; not very dense	poor	slight with cuttings				
Jasminum polyanthum	good	vigorous; flowers readily; mounds up on itself	good	moderate; no flowers				
Juniperus conferta			good	took a long time to establish; quite prostrate; moderate				
Kleinia repens	good	moderate; flowers produced	good	slow; not a vigorous competitor with weeds				
Lampranthus productus			good	weak & sparse; did not compete well with weeds	fair	slight unless protected	fair	small increase in plant size over 4-mo period
Lampranthus spectabilis	excellent	vigorous; flowers heavily; light pink	good	weak & sparse; did not compete well with weeds	good	slight	fair	grew slightly more on clay soil than sandy
Lantana x callowiana 'Sunburst'			excellent	vigorous; flowered heavily				
Lonicera japonica 'Halliana'			good	vigorous				
Lotus bertholetti	good	vigorous; dense; heavy flowering	poor	limited by poor drainage in heavy soil	fair	very prostrate due to high winds; finally died for lack of water		
Lysimachia nummularia	excellent	dense & flat	good	did not compete well with weeds; heaviest in wet soil				
Malephora crocea	good	good; rapid spread; moderate flowering	poor	little on heavy soil				
Mazus reptans	good	fast spread; forms dense mat 3 inches thick; blue flowers	poor	most plants died when attention was withdrawn				
Muehlenbeckia axillaris nana	good	vigorous in sun; shaded out by larger plants; forms dense mat	good	moderate; good coverage			poor	initial plantings were poorly rooted; survivor grew slowly in heavy soil
Myoporum parvifolium	excellent	vigorous; forms thick mat	excellent	vigorous; formed thick mat; died out suddenly due to root-knot nematode	excellent	vigorous; dense; very prostrate	fair	took a long time to establish; later well
Osteospermum fruticosum	excellent	very vigorous; makes good bank cover; attractive flowering	excellent	very vigorous & dense; flowers well	excellent	initial establishment slow but very strong in long run	good	initially sparse; longer establishment needed
Pachysandra terminalis	good	slow; light green	fair	little beyond that of established cutting				
Pelargonium peltatum			good	dense; moderate; many flower colors available				

—Continued

Evaluation of ground covers at four locations for survival and growth—Continued

Plant material	Kula		Waimanalo		Sandy Beach		Kahuku	
	Survival	Growth	Survival	Growth	Survival	Growth	Survival	Growth
Phyla nodiflora			excellent	very vigorous; good competitor with weeds; dense flat habit				
Pilea depressa			good	limited by lack of shade & water				
Polygonum capitatum			excellent	fast; colorful; dies out but reseeds itself for constant display				
Portulaca grandiflora 'Double Cerise'			excellent	rapid; when watered it stayed green; when dry, unattractive				
Potentilla verna	excellent	dense & flat; tends to mound over original cutting site	excellent	low & vigorous; tends to mound over original cutting site				
Ribes viburnifolium			none	all plants died				
Ruellia ciliosa			good	moderate; spreads rapidly by seed; purple flowers	fair	little made by cutting once established		
Sedum altissimum	excellent	good; not very dense; poor color except where well drained	good	not vigorous enough to compete with weeds				
Sedum confusum	excellent	good; heavy flowering; light green	good	established plants grew slowly	none	all plants died		
Sedum moranense	excellent	good; very flat; a reddish tinge to foliage	good	spread quickly but was smothered by competing plants				
Stenotaphrum secundatum variegatum			excellent	very vigorous				
Teucrium chamaedrys prostratum	good	plantings dense; dark green with short purple flower spikes	fair	slow; individual plants failed to grow together				
Trachelospermum asiaticum	good	moderate; sparse	fair	moderate; was overrun by competing plants				
Trachelospermum jasminoides			excellent	vigorous; dense; flowered well				
Veronica repens	good	spreads well; very flat habit	good	slow; made flat clumps				
Vinca minor	good	moderate; not very dense	fair	little on established cuttings; sparse				
Wikstroemia uva-ursi			excellent	formed dense cover about 1 ft thick				
Zephyranthes candida			excellent	clump was slow; flowered well				

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